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RESERVE COMPONENT UNIT EVALUATION ANALYSIS (COST-EFFECTIVENESS)--ETC(U)  
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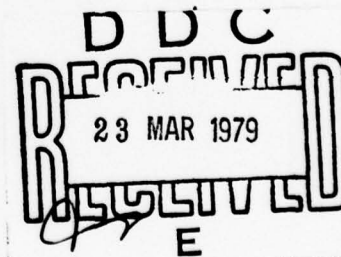
RESERVE COMPONENT UNIT  
EVALUATION ANALYSIS  
(COST-EFFECTIVENESS)

CONTRACT NO. DAAG39-75-C-0135

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RESERVE COMPONENT UNIT  
EVALUATION ANALYSIS  
(Cost-Effectiveness)

I. INTRODUCTION

A. General. This interim report is the first of two on the study Reserve Component Unit Evaluation Analysis (Cost-Effectiveness) under Contract Number DAAG39-75-C-0135. It is duly submitted three months after the start of the contract, with the second report projected for delivery in January 1976. A draft final report will be submitted not later than sixty days before the contract termination, with the final report to be delivered in mid-October 1976.

B. Purpose. The purpose of this report is to present in current detail the study plan for analysis and to apprise the Contract Officer's Representative (COR) and the Study Advisory Group (SAG) of work progress to date. The report formally reviews and updates the information presented to the COR and the SAG in a briefing at the Pentagon on 27 March 1975.

C. Organization of the Report. The report comprises five sections.

1. This introduction is the first section.

2. The second section presents the background, lists the objectives, outlines the scope, and generally describes the overall approach of the study effort.

3. The third section defines the unit evaluation options and discusses the methodology for selecting optima.

4. The fourth section identifies cost and effectiveness data elements, discusses sources and availability of data, outlines plans for data collection, and discusses methods of summarization and presentation.

5. The fifth section summarizes the plan of the study effort for the next eight months.

## II. STUDY OVERVIEW

A. Background. In developing and validating the Army Training and Evaluation Program (ARTEP) TRADOC and FORSCOM efforts have centered primarily on demonstrating the concept's feasibility, improving the ARTEP utility as a guide for training and evaluation of Army units, and very recently costing the ARTEP. Efforts have not been made specifically to define the most suitable ways of implementing the unit evaluation portion of the ARTEP. Questions of controller/evaluator numbers or sources, frequency of evaluations, applicability to different type units, aggressor sources, and the like have not been systematically studied. It is essential that the more effective options, in

this sense, be identified and that the costs of the alternative options be considered to aid the Army in selecting the economical ones. Accordingly, the Reserve Component Unit Evaluation Analysis is a cost-effectiveness study of options for evaluating units using ARTEP.

B. Objectives.

1. To analyze alternative approaches implementing the ARTEP in assessing the effectiveness of Reserve Component units.
2. To identify the costs of each alternative approach to include money, men, and collateral impact.
3. To recommend assessment systems (frequency of testing, manner of application) from among those considered for use in periodic Reserve Component evaluations with the ARTEP.
4. To identify units (by type, deployment objectives, mission to be tested) with which the assessment systems should be used.

C. Scope.

1. To a large extent the background and the objectives effectively determine the scope of the study. These foregoing are specific, for example, that the study concerns Reserve Component units and selected options for the implementation of unit evaluations under ARTEP. Also, they express clearly that cost-effectiveness analysis is required.

2. Additional guidelines relative to ARTEP to be considered and data to be sought are implicit. Six ARTEP (test editions) are currently available. Of these, four will be used by nine Reserve Component battalions during AT 75 as a part of a TRADOC/FORSCOM validation program. The current ARTEP Evaluation/Validation Schedule is presented in Table 1. Through coordination with CATB, FORSCOM, NGB, State Adjutants General concerned, and personnel of the participating Reserve Component units and the controller/evaluator groups the nine evaluations will provide the nucleus of the study data requirements. Other relevant data will be available from the review and analysis of existing data (such as 480-R or 1-R reports, OSD Reserve Component Study reports, and planning factor literature), interviews with Active Army and Reserve Component personnel, and selected controlled field observations during AT 75 and AT 76. Where and when practicable the use of these data in conjunction with other available ARTEP will be considered.

3. The concentration on Reserve Component units is not as restrictive as first may appear. Early observations in the process of fashioning implementation options showed that a wider range of evaluation options is possible for Reserve Component units than for Active Army units and that the set of Reserve Component options includes Active Army options as a subset. Thus, some Reserve Component options found to be cost-effective well may be applicable to Active Army units.

Table 1

ARTEP EVALUATION/VALIDATION SCHEDULE  
RESERVE COMPONENTS  
(as of 24 April 1975)

<u>MAJOR UNIT</u>	<u>TYPE UNIT/ARTEP</u>	<u>TIME PERIOD</u>	<u>LOCATION</u>	<u>RMKS</u>
*81st Inf Bde (M) (WA-ARNG)	Mech Inf Bn (1-161 IN)	19-25 Jun 75	Yakima	L2
	AR Bn (1-303 AR)	17-23 Jul 75	Yakima	L2
	FA Bn (DS Sp) (2-146 FA)	22-26 Jun 75	Lewis	L2
**3-117 Inf (M) (TN-ARNG)	Mech Inf Bn (3-117 IN)	16-18 Jun 75	Hood	L3
**1-123 AR (KY-ARNG)	AR Bn (1-123 AR)	23-26 Mar 75	Hood	COMPL No Tk Gnry
***67th Inf Bde (M) (NE-ARNG)	Mech Inf Bn (1-134 IN)	18-21 Aug 75	Cp Ripley MN	L3 2 - COs
	Mech Inf Bn (2-134 IN)	11-14 Aug 75	Carson	L3
	AR Bn (1-195 AR)	28-31 Jul	Carson	L3 No Tk Gnry
	FA Bn (1-168 FA)	9-12 Jun 75	Cp Guernsey WY	L2
	EN Co (867 EN Co)	18-21 Aug 75	Cp Ripley MN	L3

\*Affiliated with 9th Inf Div

\*\*2d AD roundout unit

\*\*\*Affiliated with 4th Inf Div (M)

L2, L3 indicate level tested, as shown in the ARTEP



4. The end product of the study will be a recommended set of cost-effective options for implementing Reserve Component evaluations under ARTEP. If different options are more cost-effective for different types of units, unit-specific implementation programs will be described.

D. Approach. The work to be performed is divided into three phases corresponding to the three major tasks described in the contract statement of work: Collection of Data, Analysis of Alternatives, and Development of a Recommended Program. In effect the work throughout the performance period is a methodology development effort. Also, tasks within the phases are not necessarily sequential.

1. The first phase consists of planning actions and data collection necessary for the start and conduct of subsequent analytical efforts. The planning includes the identification of data elements needed for cost-effectiveness analysis, the review of existing relevant data bases, the development of data collection materials, and the collection of data. The identification of data elements involves the definition of implementation options, the identification of major cost elements, and the definition of evaluation effectiveness. Some of the planning and most of the data activities currently, necessarily (and understandably) continue in process. Work that has been accomplished to date is appropriately the subject of sections III and IV of this report. It is noted that the submission of this report and the completion of Phase 1 work were not planned to be coincident.



2. The second phase involves the definition of analysis parameters and procedures, the analysis of collected data, and the development of relative option costs and effectiveness measures to identify the candidate ARTEP evaluation options. The work, in fact, adapts/develops and applies cost-effectiveness analysis procedures. However, because the practical adaptation/development of these procedures inherently is dependent upon the kinds, quantity, and quality of data to become available for analysis they cannot yet be finally formulated. This tautology notwithstanding the initial work in this area is discussed as a part of section III in this report.

3. The net synthesis of Phases 1 and 2 produces a subset of options estimated to be cost-effective. The subset, a complete description of its derivation, and a recommended program for testing the several candidate options in practice during the latter half of TY 76 and AT 76 are the subjects of the second interim report.

4. The third phase involves the final development of recommended assessment options, to include the planning and monitoring of a limited field implementation of the recommended systems. Clearly, the planning and monitoring require close coordination with FORSCOM and TRADOC. As a part of monitoring the work entails data collection and analysis to verify the estimates associated with the recommended options and, where applicable and feasible, to extend results to other ARTEP. For data collection it is envisaged that materials developed and

used in Phases 1 and 2 may be adapted and that additional materials can be developed as necessary. This phase and the study end with the preparation and submission of a final report of all work accomplished in the phase, all previous project activities (i.e., relevant portions from the two interim reports), and final conclusions and recommendations.

### III. ALTERNATIVE IMPLEMENTATION OPTIONS

A. Option Variables. As briefed to the SAG on 27 March 1975 three variables - evaluation schedule, controller/evaluator source, and basis of application - were selected for describing alternative options for implementing Reserve Component unit evaluations under ARTEP. Subsequently, the last of these was dropped from consideration as a variable (see below) and three other variables were identified.

1. For the evaluation schedule variable three frequencies - annual, biennial, and triennial - were chosen for consideration. It was recognized at the outset that in terms of current practice more frequent evaluations, such as annual, might place too heavy demands against available resources. Yet, with the considerations of scheduling AT periods throughout the calendar year, conducting some evaluations during inactive duty training (IDT), and using Reserve Component personnel as controllers/evaluators, options based on annual evaluations may prove cost-effective.

2. Controller/evaluator groups may be all Active Army, all Reserve Component, or selected mixes of Active Army and Reserve Component personnel.

Although there are oft heard oppositions to having Reserve Component personnel evaluate Reserve Component units, the opposition may not outweigh potentially cogent cost-effective arguments. (Of course, no cost-effectiveness argument could successfully militate against invalid test conditions whatever the invalidity factor.)

3. Basis of application is the unit mission (or type unit) or deployment objective. Under consideration following discussions with agencies listed in Table 2 and upon the suggestion of a SAG member that deployment objective is not properly an option variable it was dropped from consideration as such. However, consonant with one of the study objectives it will be used in the final review of options selected on the basis of the cost-effectiveness analysis. (See "Other Information or Guidance" in Figure 1.)

B. Other Option Variables. The three other option variables referred to above are source of aggressor, organizational level tested, and test configuration.

1. The aggressor force may be all Active Army, as it is in the AT 75 ARTEP validation exercises, or all Reserve Component. Similarly as in the use of Reserve Component personnel as controllers/evaluators, there is known opposition to using Reserve Component units as aggressor forces. Part of the argument concerns the desirability of having a standardized aggressor capability. However, on its face such capability cannot be assured even with Active Army aggressor units. With either Active Army or Reserve Component aggressor forces

Table 2

## Coordination Visits

*FEB 24	PENTAGON	DA DCS OPNS & PLANS
FEB 27	FT MONROE, VA	TRADOC - DCSOPS
MAR 4	ARLINGTON, VA	ARMY RESEARCH INSTITUTE
MAR 6	FT BENNING, GA	CATB UNIT TNG & RESERVE COMPONENT
MAR 7	FT MCPHERSON, GA	FORSCOM - DCSOPS
MAR 12	PENTAGON	NGB - DCSOT, DCSCOM & DCSLOG
MAR 18	NASHVILLE, TN	TN AG & USPFO
MAR 19	COOKEVILLE, TN	3/117 INF
MAR 19	FT KNOX, KY	ARMY READINESS REGION VI
MAR 20	FRANKFORT, KY	KY AG & USPFO
MAR 23-26	FT HOOD, TX	III CORPS G3 & DRC, 1st CAV DIV, 2nd AR DIV, MASSTER, 1/123 AR
MAR 27-28	FT MCPHERSON, GA	FORSCOM - DCSOPS & DCSCOM
APR 4	PENTAGON	OCAR - DCSOT
APR 9	FT MEADE, MD	FIRST ARMY DCSOI & OFFICE OF TNG EVAL
APR 16	RICHMOND, VA	80 TNG DIV & MTC
APR 24	FT MCPHERSON, GA	FORSCOM - DCSOPS & DCSCOM
APR 25	FT BENNING, GA	CATB UNIT TNG & RESC COMP AND INF SCHOOL

\* First of on going visits to COR



controller activity plays a significant part in assuring the validity of the test. Beyond this, whatever the merits of the opposition arguments counter arguments supporting increased Reserve Component personnel morale, additional Reserve Component unit training, and potential improved cost-effectiveness require the consideration of this variable. Finally, the use of Reserve Component units as aggressor forces permits simultaneous evaluations of two units under the opposing forces concept - a potentially economic technique.

2. The organizational level tested is largely self-explanatory. ARTEP evaluations may be administered to battalions or to companies. Although the ARTEP also include platoon and squad/crew/team testing, it is felt that for the study these organizational levels are properly included with the battalion and company evaluations.

3. Test configuration delineates the evaluated unit pure from the evaluated unit combined (i.e., with cross attached subordinate units). This delineation clearly is necessary not only to facilitate differentiation of costs but also to facilitate differentiation of effectiveness.

4. In a discussion at one agency it was suggested that evaluation site is a variable. The concern is twofold: (1) that all evaluation sites are not readily suitable for all evaluations, and that therefore there are potential cost differences, and (2) that suitable sites do not exist in sufficient number for ARTEP evaluations of all units, and that therefore the

needed number of sites must be determined and the costs associated with bringing additional suitable sites into being must be attributable to ARTEP evaluation implementation. The merit of this concern is not denied. However, the concern is seen first as a Reserve Component unit AT scheduling problem, and second as a problem to be addressed after cost-effective options are determined and selected for implementation.

C. Alternative Options. The five option variables - controller/evaluator source, aggressor source, evaluation schedule, organizational level tested, and test configuration - give rise to seventy-two basic alternative implementation options plus a to-be-determined multiple of twenty-four composite options.

1. The seventy-two options derive from constructing all possible sets of the five variables' descriptive elements (named in paragraphs A-1,2 and B-1,2,3 above) - with the Reserve Component element of the controller/evaluator source variable divided into two sub-elements: Maneuver Training Command and Other Reserve Component personnel (such as USAR Schools and training divisions). The seventy-two options are listed in the first three pages of Table 3, where each horizontal line describes an option.

2. The to-be-determined multiple of twenty-four composite options derives from constructing all possible sets of the last four variables' descriptive elements (named in paragraphs A-2 and B-1,2,3 above) and combining



Table 3

ALTERNATIVE OPTIONS FOR  
IMPLEMENTING ARTEP EVALUATIONS

Evaluator Source	Aggressor Source	Evaluation Schedule	Organizational Level Tested	Test Configuration
Active Army	Active Army	Annual	Company	Pure
			Combined	Combined
		Battalion	Pure	Pure
			Combined	Combined
		Biennial	Pure	Pure
			Combined	Combined
		Battalion	Pure	Pure
			Combined	Combined
		Triennial	Pure	Pure
			Combined	Combined
		Battalion	Pure	Pure
			Combined	Combined
	Reserve Components	Annual	Company	Pure
			Combined	Combined
		Battalion	Pure	Pure
			Combined	Combined
		Biennial	Pure	Pure
			Combined	Combined
		Battalion	Pure	Pure
			Combined	Combined
		Triennial	Pure	Pure
			Combined	Combined
		Battalion	Pure	Pure
			Combined	Combined

Table 3 (continued)

Evaluator Source	Aggressor Source	Evaluation Schedule	Organizational Level Tested	Test Configuration
Maneuver Training Command	Active Army	Annual	Company	Pure
				Combined
		Battalion	Battalion	Pure
				Combined
		Biennial	Company	Pure
				Combined
		Battalion	Battalion	Pure
				Combined
		Triennial	Company	Pure
	Reserve Components	Annual		Combined
			Company	Pure
		Battalion	Battalion	Combined
				Pure
		Biennial	Company	Combined
				Pure
		Battalion	Battalion	Combined
				Pure
		Triennial	Company	Combined
		Battalion	Battalion	Pure
				Combined

Table 3 (continued)

Evaluator Source	Aggressor Source	Evaluation Schedule	Organizational Level Tested	Test Configuration
Other Reserve Components	Active Army	Annual	Company	Pure
				Combined
			Battalion	Pure
				Combined
		Biennial	Company	Pure
				Combined
			Battalion	Pure
				Combined
		Triennial	Company	Pure
				Combined
			Battalion	Pure
				Combined
	Reserve Components	Annual	Company	Pure
				Combined
			Battalion	Pure
				Combined
		Biennial	Company	Pure
				Combined
			Battalion	Pure
				Combined
		Triennial	Company	Pure
				Combined
			Battalion	Pure
				Combined

Table 3 (continued)

Evaluator Source	Aggressor Source	Evaluation Schedule	Organizational Level Tested	Test Configuration
AA/RC Mix	Active Army	Annual	Company	Pure
				Combined
			Battalion	Pure
				Combined
		Biennial	Company	Pure
				Combined
			Battalion	Pure
				Combined
		Triennial	Company	Pure
				Combined
	Reserve Components	Annual	Company	Pure
				Combined
			Battalion	Pure
				Combined
		Biennial	Company	Pure
				Combined
		Triennial	Company	Pure
				Combined

the resulting twenty-four sets with each mix of Active Army and Reserve Component personnel selected to constitute a different controller/evaluator group. For example, for a battalion evaluation, a group might consist of the chief evaluator and other evaluators down to company level from the Active Army and the remaining evaluators for platoons and squads/crews/teams from the Reserve Components. A general set of twenty-four options to be associated with any such mixed controller/evaluator group is shown on page 4 of Table 3. It is anticipated that the number of mixed controller/evaluator groups to be considered in the study will be small.

D. Prime Candidate Options. The prime candidate options are those from among the alternative options (Table 3) selected to be recommended as a part of the program of Reserve Component evaluations under ARTEP during AT 76. The selection of prime candidate options involves two procedures: (1) by screening, the determination of sets of candidate options, and (2) by cost-effectiveness analysis, the determination of prime candidate options.

1. Screening. The screening process is accomplished in two steps. First, each ARTEP (Test Edition), in turn, is reviewed to find where in its detail it is incompatible with any of the alternative options in Table 3. Such incompatible options are selected out immediately, leaving a set of entry options for each ARTEP reviewed. Second, each set of entry options is reviewed and discussed with as many ARTEP cognizant agencies (Table 2) as possible. Also,



to the extent possible each set of entry options is reviewed with controllers/evaluators and Reserve Component personnel involved in the AT 75 ARTEP validation program. Based on the expert military opinions rendered in these reviews unlikely entry options are dropped from further consideration, leaving a set of candidate options for each ARTEP reviewed.

2. Cost-Effectiveness Analysis. The cost-effectiveness analysis is based on a simple model which permits the manipulation of candidate options and their associated costs and effectiveness to achieve optimum visible levels of cost-effectiveness among the several ARTEP evaluation implementation options. The model, Figure 1, functions as follows:

a. Costs for each option in each set of candidate options are aggregated to give total cost (or total incremental cost) for each candidate option.

b. Effectiveness data for each option in each set of candidate options are combined to give an index of effectiveness (or index of marginal effectiveness) for each candidate option.

c. If a maximum acceptable option cost is provided (or can be determined) options having costs in excess of the maximum are dropped from further consideration.



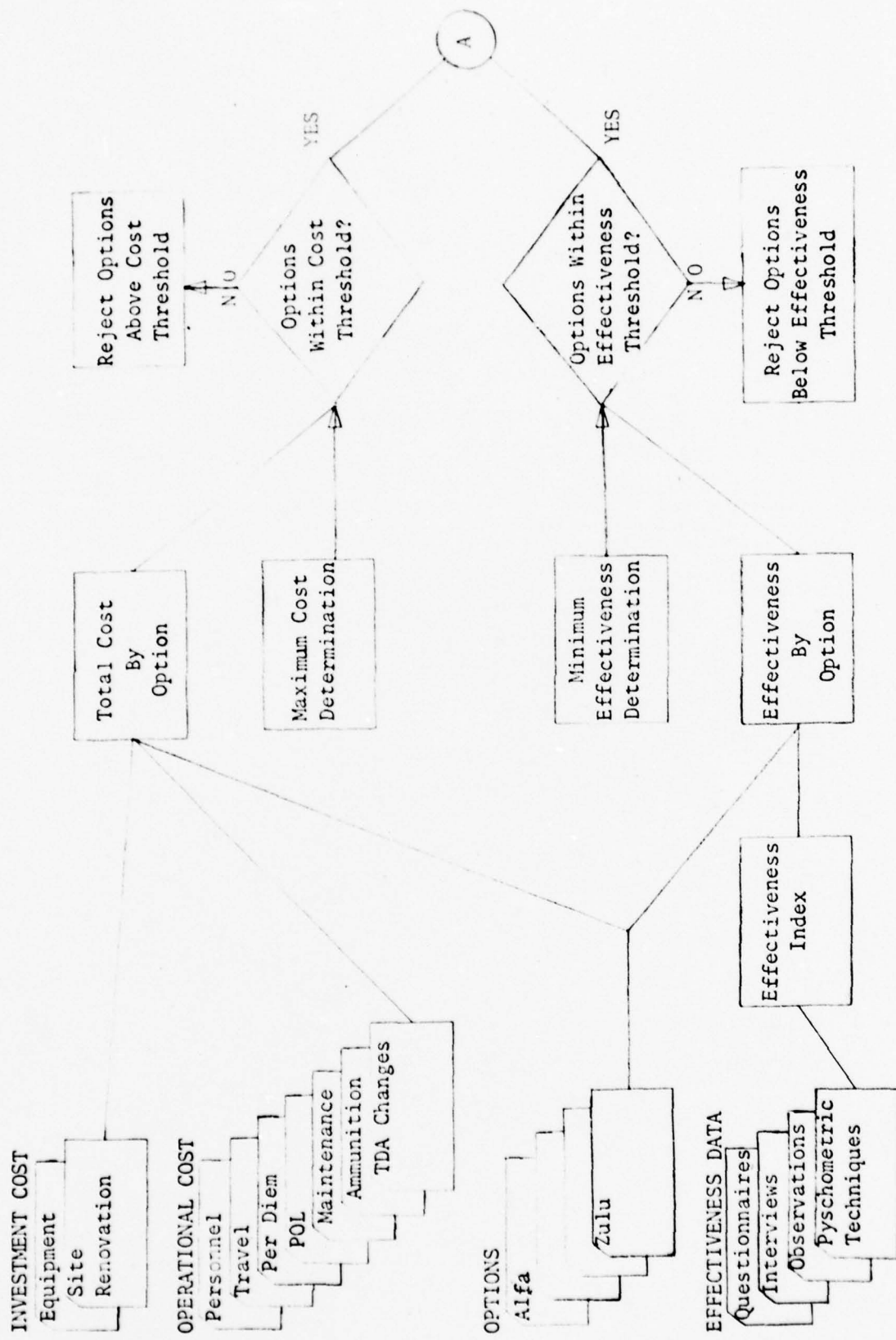


Figure 1. ANALYSIS LOGIC

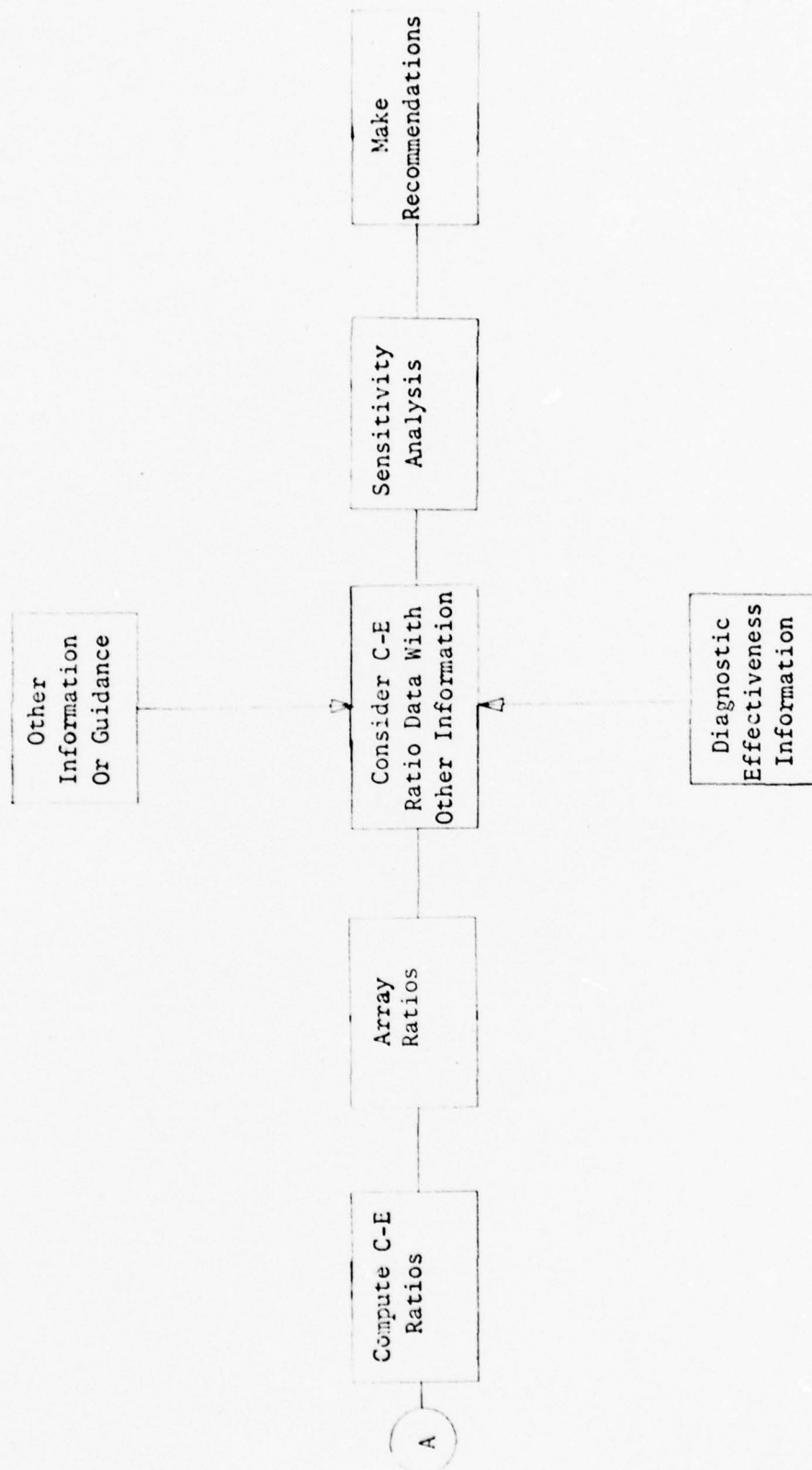


Figure 1. ANALYSIS LOGIC (continued)

d. If a minimum acceptable option index of effectiveness is provided (or can be determined) options having indexes smaller than the minimum are dropped from further consideration.

e. For each remaining option, in turn, in each set of candidate options the ratio of the index of effectiveness to the total cost is formed and calculated, or the index of effectiveness and the total cost are used as rectangular coordinates to plot a representative point. Figure 2 illustrates the plotting. The points 1, 2, 3, 4, and 7 normally would not be plotted on the bases of paragraphs c and d preceding.

f. For each ARTEP the ratios associated with its set of candidate options are ranked from largest to smallest, and relative to a provided (or determined) criterion the prime candidate options are identified as those whose ratios exceed the criterion. Where representative points are plotted the decision maker has several choices. With reference to Figure 2, for example, points 5 and 6 are dominated respectively by points 8 and 9 - i.e., with the same effectiveness point 8 has lower cost than point 5 and for the same cost point 9 provides more effectiveness than point 6. Thus, point 9 would be the choice if highest effectiveness is desired and point 8 would be the choice if lowest cost is desired. Point 10 represents the option with the most effectiveness per unit cost. Among the candidate options 8, 9, and 10 it is the optimal efficiency candidate option, and would be the decision maker's choice if he desires the "best buy".

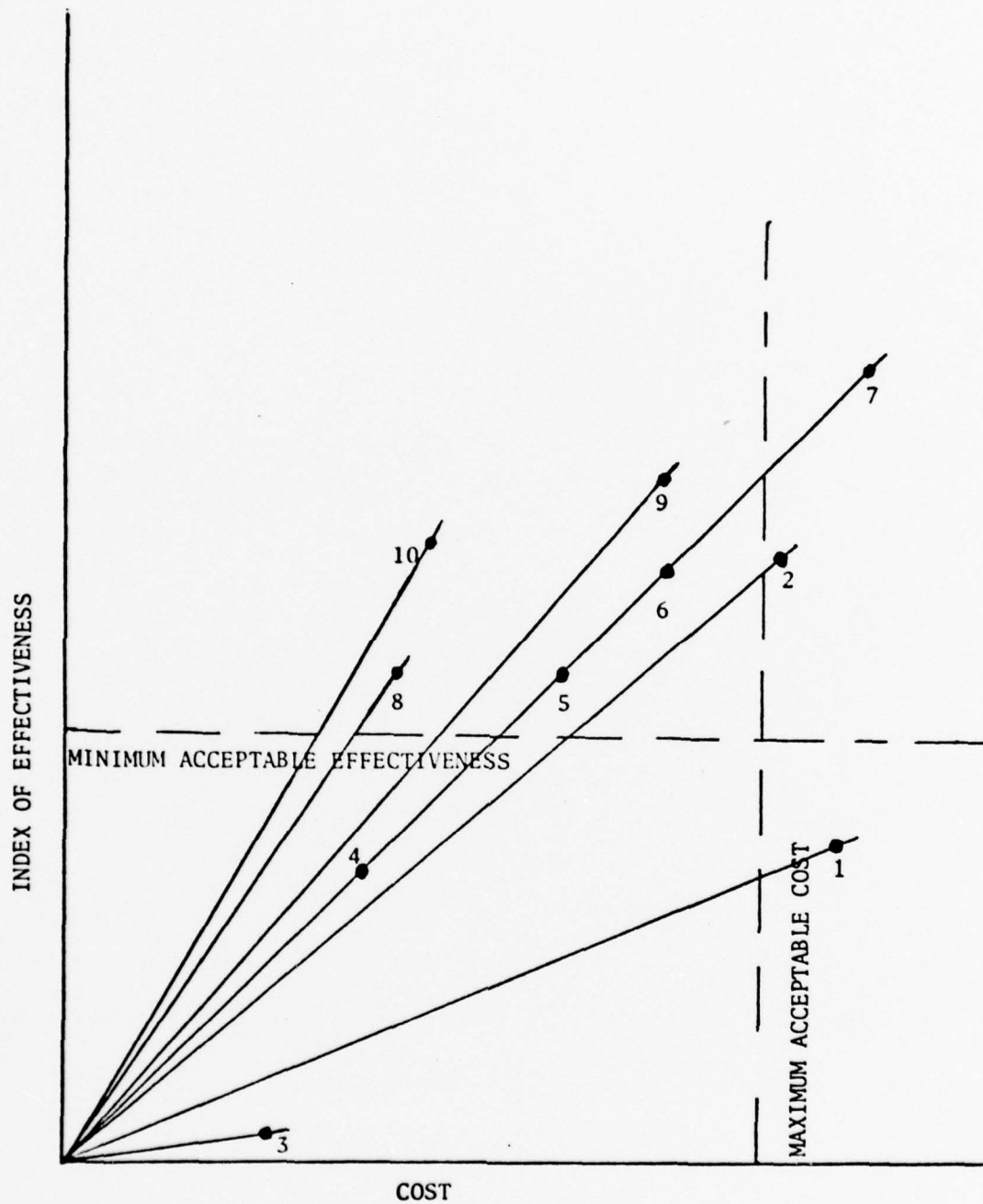


Figure 2. COST-EFFECTIVENESS RATIO MODEL

g. Diagnostic type effectiveness and other cost information, where applicable, are used to reduce the list of prime candidate options.

3. Sensitivity Analysis. Because option effectiveness is to be expressed in terms of an index developed from subjective and generally qualitative information (ref section IV C) and because cost data are to be projected across options there is an element of uncertainty in the cost-effectiveness analysis. Although this problem cannot be avoided in cost-effectiveness analysis, it also cannot be ignored. By means of sensitivity analysis methods, testing the index of effectiveness to total cost ratio across a range of effectiveness values and a range of cost values, it will be determined which elements of effectiveness and which elements of cost have the greatest effect within the set of prime candidate options. The sensitivity analysis also may identify the region of ratio results of greatest sensitivity. However, because there are a large number of options, each with its own set of variables, the cost-effectiveness model may exhibit a built-in sensitivity analysis technique which will make a separate analysis unnecessary. However the sensitivity analysis is accomplished it is vitally important to understanding any implications of the selected prime candidate options.

#### IV. COST/EFFECTIVENESS DATA

A. General. Cost-effectiveness analyses in general and this cost-effectiveness analysis in particular require large amounts of information and data. In the area of costs, although the Army generates and reports significant amounts of quantitative information, not all required cost data for this study



analysis are available - in fact, or in useable form. In the area of effectiveness measures much less of the required information is available so that most must be generated and collected during the study. In what follows, as a part of work accomplished during this first phase of the study, cost and effectiveness data requirements are defined, sources of existing data are identified, and plans for collecting data are described.

B. Cost Data.

1. Requirements. Various interested headquarters and agencies were visited in person and by telephone to assist with the identification of data elements necessary for the study. In conferences with FORSCOM, Combat Arms Training Board (CATB), and III Corps the costs listed in Table 4 were identified.

a. Investment Cost. The elements of investment cost to be considered are those associated with positioning equipment and construction costs for renovation of Annual Training (AT) sites required to support ARTEP evaluations. Investment cost will be amortized to reduce the impact on the evaluation cost in the first year.

b. Operational Cost. Operational cost will be considered only to the extent that it is incremental to the support of ARTEP evaluations. The operational costs are funded by Operation and Maintenance as well as Military Personnel appropriations for Army, National Guard and Army Reserve. Procurement of Ammunition, Army appropriation funds will be considered if ammunition is determined to be incremental.



Table 4  
COST ELEMENTS

Investment Cost

Equipment positioned to support evaluations

Site renovation

Operational Cost

Personnel required for evaluations segregated by:

Evaluation Headquarters - the planning and evaluation staff responsible for the preparation for conduct of the exercise.

Evaluators - personnel responsible for the conduct of the evaluation

Aggressors - personnel responsible for the role of portraying the enemy

Support Personnel - other personnel required e.g., range personnel

Travel necessary for personnel support

Per diem for personnel necessary to conduct evaluations

POL consumed for evaluations segregated by:

Evaluation Headquarters

Evaluators

Aggressors

Support Personnel

Maintenance costs to include repair parts

Ammunition

Personnel added to the MTC TDA

c. Costs not considered in this study.

(1) Evaluator training costs, because such training is conducted prior to the exercise regardless of the type evaluation.

(2) Self service supply center costs, because supplies will be consumed in the preparation for any type evaluation.

(3) Medical support costs, because such support is required for any evaluation.

(4) Pay of personnel costs for the unit being evaluated, because they are present regardless of type evaluation.

## 2. Sources.

a. Investment Cost. No investment cost data have been identified to date because evaluations have thus far been accomplished on Active Army installations. Evaluations may require investment cost to permit their conduct as implementation of ARTEP is expanded. The source of data would be the installation DCSCOM for Army installations and the State United States Property and Fiscal Office (USPFO) for the National Guard.

b. Operational Cost. It has been found that budget data is available for the cost to support evaluation of Reserve Component (RC) units on active army installations; however, a detailed actual cost feedback system

is not available. Costs associated with training are available in gross figures but they are not broken out by battalion or field exercise. Only incremental cost in support of evaluations associated with ARTEP recognized requirements will be considered. Those costs incurred which are above those requirements established by the ARTEP, e.g., for the sake of realism or because of relationships developed through the affiliation or roundout programs, will not be considered. A list of visits for coordination, assistance, and to plan data collection is contained in Table 2 on page 10. Telephonic communications with the personnel visited will be maintained as a part of keeping in touch with a dynamic ARTEP validation program.

(1) A visit to III Corps determined that budget figures are available in the Directorate of Reserve Components for support of 1/123 Armor of Kentucky and 3/117 Infantry of Tennessee. Actual cost, less POL, for 1/123 Armor will be available in the Directorate of Reserve Components by June. The visit identified the cost factor tables used by III Corps and Modern Army Selected Systems Test Evaluation and Review Activity (MASSTER). They were based on investment costs for engineer type equipment valued up to \$50,000. These costs were extrapolated to \$750,000 for items of the Army equipment known to cost more than \$50,000. III Corps charges 80% of the factor cost because the National Guard provides the POL for the equipment supplied for their use. MASSTER has a data base for the tests it conducts citing all equipment used; however, the rate factors used to determine cost for equipment usage are suspect.

(2) The 1st Cavalry Division has a man performing duty as a financial manager in the G3 office. The data processing system used to control expenses captures only about 60% of the costs he is responsible to control. The factors he uses for costing field exercises, based on a Field Operations Cost Agency document, were reviewed. Controller of the Army advised that FOCA had gone out of business and their data was obsolete.

(3) A visit to the Kentucky State Adjutant General (AG) and USPFO in Frankfort determined that POL consumption data will be available for both 1/123 and 2/123 Armor. An interesting test situation existed at Fort Hood in that 1/123 Armor was evaluated against ARTEP while 2/123 Armor was evaluated against the ATT. It may be possible to draw conclusions from a comparison of the costs in this case. The 1/123 Armor did not fire the tank tables. The ammunition requirement was not to exceed the common table of allowance (CTA) limits.

(4) The visit to the Tennessee State Adjutant General and USPFO in Nashville developed data for the 3/117 Infantry for Army Training Test (ATT) in AT 74 and assurances were given that cost data would be accumulated for AT 75 which is scheduled for June. The 3/117 Infantry considers the CTA ammunition allowance adequate, so no additional cost is expected for ammunition.

(5) FORSCOM DCSCOM has ATT cost data in its data bank but it does not include data for the National Guard. Coordination with the State AGs and USPFOS became more important since all RC units utilizing the ARTEP in AT 75 are National Guard. It was confirmed that cost factors used by III Corps for costing support of RC units and MASSTER for various tests should not be used because of the data base and the extrapolation used to develop the tables.

(6) CATB is developing a cost model for the ARTEP (training and evaluation) for active Army units. They propose to collect ARTEP associated costs (POL, Ammunition, Maintenance to include spare parts, and Supplies) for one year. Data generated may be applicable to the RC cost-effectiveness study. The CATB model does not consider the personnel required (evaluation headquarters, evaluators and aggressors) to support the evaluation. Liaison will be maintained with CATB for applicability to the RC cost-effectiveness study.

(7) Fort Carson, Colorado and the 4th Infantry Division (M) DCSCOM, in recognition of the fact that unit training activity costs do not exist at division level, developed a plan to obtain actual cost data on POL, maintenance and repair parts in field exercises. They propose to develop cost factors for operating costs (POL and repair parts) for equipment. While



the ability to cost training activities will be a valuable tool in managing limited training funds, the adequacy of this data for possible utilization in the RC cost effectiveness has not been determined.

(8) Fort Lewis, Washington and the 9th Infantry Division have not yet been visited to determine the adequacy of data on RC unit support or any efforts to develop the cost of training activities. The 9th Infantry Division costs for ARTEP validation, as reported to CATB in an after action report, appear to be excessive and require clarification.

(9) FORSCOM has developed an effort to capture POL, maintenance and spare parts cost data at the active duty division installations. The purpose of this effort is to assist in the development of factors for the operation and maintenance of equipment for costing RC unit support. Collection is planned to begin on July 1st. FORSCOM is reviewing the Leavenworth Model for costing a battalion day in the field which would require collection of the same operating costs as those required for the costing support of RC units. FORSCOM also plans controlled tests to capture cost data for both ORTT and ARTEP evaluations for battalions (Armor, Infantry, and Field Artillery as a minimum) during FY 75. These efforts will be monitored to determine applicability to the RC cost-effectiveness study.

(10) The Army Readiness Region (ARR) III MTC in Richmond, Virginia has data on manday support being supplied to present RC ATT evaluations. The Maneuver Training Command (MTC) administrator advised he felt the MTC would welcome the opportunity to provide evaluators for the ARTEP evaluations as they replace the ATTs for RC units. The MTC could be a repository of evaluation expertise and could add a measure of standardization to evaluations beyond the capabilities of an Ad Hoc type evaluation group.

(11) Office Chief of Army Reserve (OCAR) has a FORSCOM proposed TDA for a type MTC recommending an increase from 315 to 350 personnel. DAMO has recommended the approval of evaluators be made tentative pending completion of the RC cost-effectiveness study since it will consider utilization of MTC personnel as evaluators. OCAR advises they will furnish cost data associated with the increase in costs.

3. Data Collection Plan. Existing data were reviewed and collection accomplished where possible on the coordination visits listed in Table 2. The bulk of the data required for this study remains to be collected. Visits are planned to battalions undergoing their ARTEP evaluations (Table 1), the staff at the installations where they are being conducted, the State Adjutants General and the State USPFs as reflected in Table 5. CATB advised that requirements for data collection may be included in the after action report

Table 5

PLANNED DATA COLLECTION VISITS

FT DIX, NJ	ARMY READINESS REGION II
FT DEVENS, MA	ARMY READINESS REGION I
FRANKFORT, KY	STATE AG & USPFO
FT KNOX, KY	ARR VI & ARMOR SCHOOL
NASHVILLE, TN	STATE AG & USPFO
TOPEKA, KS	STATE AG & USPFO
LINCOLN, NE	STATE AG & USPFO
DENVER, CO	STATE AG & USPFO
FT CARSON, CO	G3, G4, COMPT, DRC & 2/123 IN
YAKIMA, WA	1/161 INFANTRY
SEATTLE, WA	STATE AG & USPFO
FT LEWIS, WA	G3, G4, COMPT, DRC & 2/146 FA
FT HOOD, TX	G3, G4, COMPT & DRC

instructions CATB will issue prior to each evaluation. To the extent possible, efforts will be made to adapt existing data rather than impose new data collection efforts. Liaison will be maintained with contacts in the field to keep abreast of the ARTEP validations and data collection efforts.

4. Treatment. The cost data collected will be treated as outlined in the methodology described in paragraph III D. The analyses and processes to be utilized are subject to refinement and testing throughout the span of the study to increase the confidence levels in the validity of the results.

#### C. Effectiveness.

1. Definition. Effectiveness is considered to be function of the extent to which ARTEP evaluation meets its stated objectives and fulfills the implicit functions of any evaluative system, namely, to provide valid and useful feedback. The primary concern is the process by which the objectives are met, i.e., the man (evaluator) - instrument interface, taking the instrument as a given.

#### 2. Common ARTEP Objectives.

a. "To evaluate the ability of a [type] battalion to serve as a nucleus of a combined arms task force performing specified missions under simulated combat conditions." For this objective effectiveness determination

is concerned primarily with the accuracy and completeness (together, validity) of the information rendered through conduct of the evaluation.

b. "To provide a guide for training objectives by specifying minimum standards of performance for combat-critical missions and tasks." This objective relates to training only and will not be incorporated in measures of evaluation effectiveness.

c. "To evaluate the efficiency and effectiveness of past training of all echelons of the battalion from crew/squad through battalion/task force." Effectiveness with regard to this objective rests upon the extent to which the evaluation yields information which reflects changes in unit (or sub-unit/element) performance through a test-train-retest cycle.

d. "To provide an assessment of future training needs." Relative to this objective effectiveness determination is concerned with the diagnostic ability of the evaluation process, i.e., its ability to convey the causes of mission failure or unit/element training deficiencies to the end that evaluation results are translatable into corrective training recommendations.

### 3. Data Collection.

a. Background. In the analysis preparatory to undertaking the current study, three candidate measures of effectiveness (MOE) were defined:



adequacy of information, user acceptability, and promotion of proficiency gains. The two former MOE are retained and incorporated with the above effectiveness determinants relative to ARTEP objectives. For the latter indicator, it was generally assumed that for quantification of readiness gains either training REDCON levels or number of weeks to achieve combat proficiency would be used. However, a review of historical data to obtain such readiness indices has been suspended for three basic reasons. First, results of OSD Tests and Affiliation Program feedback both point to inflation in 480-R reports. Second, the four-point readiness level scale, of which only the middle two are commonly assigned, represents a scale insensitive to all but substantial changes in proficiency. Last, and most cogent, this study is concerned only with the evaluation function of ARTEP, while proficiency gains represent at best an indirect index of evaluation effectiveness due to the many other factors which impinge upon training, e.g., leadership, personnel turbulence, time and resource constraints.

b. Identification of Data Elements. Data requirements are summarized in Table 6.

(1) It has been determined that all data needed for the conduct of effectiveness analysis will be obtained from on-going and future activities, to include observation of ARTEP evaluation and validation exercises, surveys and in-depth interviews of personnel involved, large-scale

Table 6

## EFFECTIVENESS DATA REQUIREMENTS

<u>EFFORT</u> *	<u>DATA SOURCE</u>	<u>PURPOSE</u>
1	Large pool of AA & RC Officers (echelons up to DA & NGB): via mail-out questionnaires	To develop effectiveness index relative to implementation options for use in cost-effectiveness model
2	CO & S-3 of all tested units & responsible parties in reporting chain: via structured interviews/ follow-up questionnaires	To poll user acceptability & gain judgment of information adequacy
3	ARTEP Validation results, after action reports, FORSCOM Form 1-R, ARTEP evaluators via questionnaires, FORSCOM evaluators via questionnaires, & unit training personnel via structured interviews	To judge accuracy & completeness of feedback from ARTEP evaluation using independent data source
4	AT 75 ARTEP evaluation results AT 76 ARTEP evaluation results	To assess the efficiency of ARTEP evaluation to produce feedback relative to training effectiveness

\*Numbers correspond to efforts outlined in paragraph 4.

mailings of questionnaires in two-phases, and systematic review and analysis of ARTEP results and evaluator comments.

(2) Coordination visits made to date and those anticipated in the near future are depicted in Tables 2 and 5, (pp 10, 32) respectively.

(3) During coordination visits the study and how it relates to current Army efforts were discussed at length. Visited agencies are cooperating to furnish pertinent data as they are obtained. Additional recommendations and suggestions for ARTEP implementation options to be considered were solicited. During coordination visits the various effectiveness elements and options also were discussed with RC and Active Army personnel.

(4) Reports of the on-going ARTEP validation exercises are a basic source of effectiveness data. These reports teamed with in-depth discussions with TRADOC, FORSCOM, and CATB personnel plus evaluators and others involved with ARTEP and ARTEP implementation constitute the core of the effectiveness data sources.

4. Approach. There will be four separate but related efforts involved in the analysis of ARTEP implementation effectiveness.

a. The first and major effort is directed toward predicting the relative ability of implementation options to render accurate and usable information (relating to ARTEP objectives a, c and d). This determination will be derived through scaling [psychometric projection] of relative evaluation effectiveness of various implementation schemes based on expert military judgment. This effort can be expected to reflect projections of user acceptability as well. The detailed methodology for this effort is presented in the following section (para 5).

b. The second effort will attempt to ascertain user acceptability at all levels of responsibility and interest. This indicator of effectiveness will be gained through post-exercise interviews and follow-up questionnaires, as well as through review of validation after-action reports. Coordination and cooperation is anticipated with CATB and FORSCOM for the collection of mutually supportive documentation during and immediately following validation exercises. This effort is concerned with user acceptability of the evaluation system, as well as the usefulness of information derived. The thrust of this effort will be to determine if responsible parties at each progressive echelon feel that they have the type and quantity of information they require to make valid decisions and to meet their directive and reporting functions. This effort relates to ARTEP objective a, c and d).



c. The third effort consists of three steps.

(1) The first step is aimed at an independent assessment of the accuracy and sufficiency of feedback data and will constitute a systematic review of ARTEP results. This initial step will consist of an item comparison of ARTEP results (deficiencies noted) with the critique of training readiness rendered by the three-man Active Army evaluation team present during the same exercise (and throughout AT) but not involved in the ARTEP implementation or evaluation. While it is acknowledged that reporting requirements of the team differ from that of ARTEP evaluators, both are assessing training proficiency and interested in noting weaknesses within the evaluated unit. The comparison of ARTEP results and the independent evaluation by the three-man team will look at the relative amounts of information generated, the separate type of information provided, noted deficiencies which are absent in either source, and essentially the degree to which they represent parallel or divergent perspectives of a unit's level of training.

(2) The second step of this effort will seek verification of ARTEP results and the readiness evaluation team data (in terms of overall evaluation and specific deficiencies noted) from evaluated unit's personnel (especially CO and S-3). This step will be accomplished by follow-up questionnaire or interview, tailored to each unit, after all exercise reports



have been submitted and commanders and training personnel have had adequate time to review them. The purpose of this step is to achieve an indication of relative perceived accuracy of the two sources of evaluative information.

(3) Finally we will want to learn from battalion personnel if there are any known areas of deficiency not detected by either evaluation procedure. The integration of the three above steps should yield a good, qualitative indication of the accuracy and completeness of feedback data from the ARTEP evaluation. (This effort relates to ARTEP objective a.)

d. The proposed fourth analytical effort is concerned with the effectiveness of the ARTEP evaluation in providing feedback relative to efficiency of training conducted during IDT. This task will entail comparison of same-unit ARTEP results from AT 75 and AT 76. It is recognized that certain test units will need to be designated to undergo re-evaluation out of phase for this task to be undertaken. Also, the evaluations should be as comprehensive as possible or at least include the same types of missions. Comparison of two year test results will yield three categories: areas of deterioration, areas of no change, and areas of improvement. These three categories would then be corresponded to instructional elements of the unit's TY 76 training program. Analysis will have also to consider the rate and levels of personnel turbulence incurred by the unit during TY 76. In total this technique will point up types

of training which were successful, those that were less efficient, and others which were lacking. It will also be possible to determine through this effort the extent to which the TY 76 training program emanated from results of ARTEP AT 75. (This approach relates to ARTEP objective c.)

5. Field experimentation. In addition to the four efforts outlined in the approach above (para 4), experimental comparison of prime candidate implementation options may be possible through either of two methods. If prime candidate options are field tested during AT 76, comparison of AT evaluation effectiveness ratings for two or more like units tested under different options should offer direct verification of rankings achieved in the first major effort described below (para 5). The other access to experimental comparison could be achieved in conjunction with effort number four (para 4d). This latter comparison would be possible for same units evaluated under different options during AT 75 and AT 76.

6. Method. Following is a discussion of the methodology anticipated in the execution of the first effort to achieve a quantitative scaling of ARTEP implementation options. The second, third, and fourth efforts described above will yield, in general, more qualitative and diagnostic information and will be used to modify the results of the first effort. It should further be noted that efforts 2-4 will yield indications of relative effectiveness only for options which have actually been field tested, but as conceived, will

not generate data pertinent to untested implementation options. The methodology comprises these five steps:

- Identify option variables
- Assemble option ranking packages and rating packages to be completed by two groups of military judges
- From ratings of expert military judges, develop effectiveness index for each option
- From rankings of option subset by expert military judges, develop option ranks
- Using ranking and rating results, conduct sensitivity analysis to assess the contribution of option variables to option effectiveness.

a. Initially the options, arranged in subsets due to their large number, will be presented to a large sample of Reserve Component and Active Army officers for the assignment of ratings on a 0-9 scale. The number nine on the scale will be defined as belonging to an "ideal" evaluation system and zero will represent the absence of evaluation. Establishing a zero reference point will enable ratings to be treated in the manner of a ratio. The ideal evaluation system will be described as being capable of identifying

and diagnosing 100% of all actual deficiencies while making no specious identification, and being able to correspond all deficiencies with requisite corrective training compatible with a unit's training support resources. Results of the rating exercise will be normalized and converted to scale values using standard statistical procedures. These scale values will be the basis of the effectiveness index to be used in the cost-effectiveness ratio.

b. Concurrently, mixed subsets of options will be submitted to a second group of military judges to be placed in rank order from "most effective" to "least effective." Subset ranks will be integrated to achieve an overall ranking of the total set of options. Sensitivity analysis can be performed on the rankings to determine the relative importance (weight) of the five implementation variables to evaluation effectiveness. This will be accomplished by examining the distribution of descriptive elements of each variable within the rankings. (Examples: a cluster among the high ratings indicates a strong positive influence; even distribution throughout indicates little or no influence; a cluster among low rankings indicates strong negative influence.) The rankings will also be used to establish the level of confidence to be attached to option ratings. This is to be done through an examination of correspondence between results of ranking and rating exercises.



c. Both samples of judges will be comprised of 1/3 Active Army, 1/3 USAR, and 1/3 ARNG. The emphasis in the collection sample, as in the overall study, is on the Reserve Components. For purposes of analysis, RC and AA respondents will be treated as separate populations because components of evaluation options may differ in effectiveness between the Active Army and Reserves.

d. As suggested earlier, the validation exercises run during CY 75 will present implementation options for which effectiveness index values can be generated. Other options to be examined can then be considered of incremental or decremental effectiveness relative to these base cases.

e. In disseminating the rating packages, ARTEP will be described as the context for the evaluation, but direct experience with ARTEP or conceptual understanding is not considered essential for making the judgments called for above. Effectiveness ratings for different versions of ARTEP will be handled in the following manner. Options for implementation of the infantry ARTEP will be rated by infantry officers only, signal ARTEP by signal officers, armor ARTEP by armor officers, and so forth. For variables or options relevant to all ARTEPs, responses can be pooled. For those that are relevant only to specific versions, they will be analyzed by branch (Example: source of aggressor is not relevant to ARTEP 11-35, Signal Bn). Evaluators who have



participated in ARTEP validation exercises will be requested to complete the same rating tasks, but will be considered a separate population, with the intended purpose of offering an objective comparison (i.e. - a check for bias).

## V. SUMMARY

A. The foregoing sections present an overview of the Reserve Component Unit Evaluation Analysis (Cost-effectiveness) study, a discussion and list of alternative options for implementing evaluations under ARTEP, a method for selecting prime candidate options, a list of cost data requirements and an associated data collection plan, a discussion of effectiveness measurement, a plan for obtaining effectiveness information, and an overall report of work done to date.

B. The work done to date, including the preparation of the first interim report, is a part of Phase 1 in this three phase study. Phase 1 work now continues. It entails the designing and developing of interview forms, surveys, data recording forms, and tabulation worksheets - coordinated with the Army ARTEP evaluation team as necessary; coordinated receipt of AT 75 Reserve Component unit evaluation after action reports and other validation information as it becomes available; coordinated collection of cost data; coordination visits and re-visits to cognizant military agencies; evaluation exercise

observation and information gathering visits to AT sites; visits to unit headquarters to conduct interviews and to collect cost data; conduct of surveys by mail.

C. Phase 2 work, some of which overlaps with Phase 1, commences with the analysis of cost and effectiveness data on an option-by-option basis, with differentiation by unit type, specifically for those options employed in the validation exercises during AT 75; includes the projection of cost and effectiveness data to other options as pertinent, with associated analysis; proceeds with the cost-effectiveness analysis method, shown in Figure 1, (page 19) to select prime candidate implementation options; and culminates in January 1976 with the submission of the second interim report presenting recommendations for testing the prime candidate implementation options in Reserve Component Unit evaluations under ARTEP during the latter half of TY 76 and AT 76.